DESCRIPTION OF THE DRAWINGS

FIG. **1** is a cross-sectional view of a gas turbine engine component having a thermal/environmental barrier coating system in accordance with this invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is generally applicable to components that operate within environments characterized by relatively high temperatures, and are therefore subjected to severe thermal cycling and stresses, oxidation, and corrosion. Notable examples of such components include combustor components, high pressure turbine vanes, and other hot section components of gas turbine engines. A surface region **12** of a hot section component **10** is represented in FIG. **1** for purposes of illustrating the invention. The component **10** or at least the surface region **12** of the component **10** is formed of a SiC/SiC composite material, though the invention is believed to be generally applicable to any material containing a silicon-based material in any form.

As shown in FIG. **1**, the surface region **12** is protected by a thermal/environmental barrier coating (TBC/EBC) system **14** that includes a bond coat **16** and a top coat **18**. The coating system **14** provides environmental protection to the underlying surface region **12** as well as reduces the operating temperature and thermal gradient through the bond coat **16** and the component **10**, thereby enabling the component **10** to survive within higher-temperature environments than otherwise possible. Suitable materials for the top coat **18** include zirconia partially or fully stabilized with yttria (YSZ), e.g., about 7 weight percent yttria, and yttrium silicate, though it is foreseeable that other ceramic materials could be used.

The major mechanism for degradation of silicon carbide in a corrosive environment is the formation of volatile silicon monoxide (SiO) and silicon hydroxide ($Si(OH)_4$) products. The diffusivity of oxidants in materials suitable for the top coat **18** is generally very high. Therefore, in order to protect the SiC-containing surface region **12**, the bond coat **16** must exhibit low diffusivity to oxidants, e.g., oxygen and water vapor, to inhibit oxidation of the silicon carbon within the surface region **12**, while also being sufficiently chemically and physically compatible with the surface region **12** to remain adherent to the region **12** under severe thermal conditions. According to this invention, the bond coat **16** fulfills these requirements if formed of barium strontium aluminosilicate (BSAS). In a preferred embodiment, the coating consists essentially of barium strontium aluminosilicate. A suitable thickness for the BSAS bond coat **16** is about 25 to about 500 μm, though greater and lesser thicknesses could foreseeably be used.

As indicated above, the BSAS bond coat **16** of this invention provides adhesion of the top coat **18** and is physically compliant with a SiC-containing substrate. Simultaneously, the BSAS bond coat **16** serves as an environmental barrier, since it exhibits low silica activity and low diffusivity to oxidants, thereby inhibiting the growth of an interfacial silica layer at the surface region **12** when the component **10** is exposed to the oxidizing environment of a gas turbine engine. BSAS is also physically compatible with the SiC-containing surface region **12** in terms of having a CTE of about 5.27 ppm/°C., as compared to a CTE of about 4.9 ppm/°C. for SiC ceramic matrix composites (CMC). Finally, BSAS exhibits low alumina activity, which inhibits the formation of aluminosilicates that would create an undesirable CTE mismatch at the interface between the bond coat **16** and surface region **12**. As a result, the TBC/EBC system **14** of this invention is able to thermally and environmentally protect the SiC-containing surface region **12** over numerous thermal cycles and at elevated temperatures as a result of being chemically and physically compatible with SiC. Advantageously, the BSAS bond coat **16** of this invention exhibits sufficient environmental resistance such that, if the top coat **18** were to spall, the bond coat **16** continues to provide a level of environmental protection to the underlying SiC-containing surface region **12**.

As with prior art bond coats and environmental coatings, the BSAS bond coat **16** of this invention can be deposited by air and vacuum plasma spraying (APS and VPS, respectively), though it is foreseeable that deposition could be performed by other known techniques, such as physical vapor deposition (PVD) and high velocity oxy-fuel (HVOF). The top coat **18** can be deposited on the bond coat by known techniques, including plasma spraying and PVD techniques. Thereafter, a heat treatment may be performed after deposition of the bond coat **16** and/or top coat **18** to relieve residual stresses created during cooling from elevated deposition temperatures.

While our invention has been described in terms of a preferred embodiment, it is apparent that other forms could be adopted by one skilled in the art. In particular, the benefits of the thermal/environmental barrier coating system of this invention can be realized for various substrate materials containing silicon or a silicon-based material. Accordingly, the scope of our invention is to be limited only by the following claims.

What is claimed is:

1. An article comprising:

a substrate comprising silicon;

a bond coat on the substrate, the bond coat comprising barium strontium aluminosilicate; and

a top coat on the bond coat.

2. An article as recited in claim **1**, wherein the bond coat consists essentially of barium strontium aluminosilicate.

3. An article as recited in claim **1**, wherein the bond coat consists of barium strontium aluminosilicate.

4. An article as recited in claim **1**, wherein the top coat is a ceramic material.

5. An article as recited in claim **1**, wherein the top coat is formed of a material selected from the group consisting of yttria stabilized zirconia and yttrium silicate.

6. An article as recited in claim **1**, wherein the substrate is formed of silicon carbide particles dispersed in a matrix material.

7. An article as recited in claim **1**, wherein the substrate is formed of a composite having a silicon carbide matrix.

8. An article as recited in claim **1**, wherein the substrate is formed of a composite having silicon carbide reinforcement in a silicon carbide matrix.

9. An article as recited in claim **1**, wherein the bond coat has a thickness of about 25 to about 500 micrometers.

10. An article as recited in claim **1**, wherein the article is a component of a gas turbine engine.

11. An article comprising:

a substrate containing silicon carbide;

a bond coat on the substrate, the bond coat consisting of barium strontium aluminosilicate; and

a thermal-insulating layer overlying the bond coat.

12. An article as recited in claim **11**, wherein the thermal-insulating layer is selected from the group consisting of yttria stabilized zirconia and yttrium silicate.

13. An article as recited in claim **11**, wherein the substrate is formed of silicon carbide particles dispersed in a matrix material.